What is claimed is:

1. An image data correction method for correcting image data picked up from an original image photographed in an exposure frame on a photographic film through a taking lens while holding the exposure frame curved along a direction of the exposure frame, so as to eliminate image distortion in the original image, said image data correction method comprising the steps of:

setting up an orthogonal coordinate system having an origin at an intersection between an optical axis of the taking lens and the exposure frame, the X-axis of said coordinate system extending in the curved direction of the exposure frame, and the Y-axis of said coordinate system extending perpendicularly to the optical axis of the taking lens;

approximating distortion in an image obtained by photographing straight-linear lines extending in the X-axis and Y-axis directions through the taking lens to circular arcs, wherein distortion in a first straight-linear line extending in the Y-axis direction is approximated to a circular arc which have a center of curvature on the X-axis and passing across an intersection of said first straight-linear line with the X-axis, and distortion in a second straight-linear line extending in the X-axis direction is approximated to a circular arc which have a center of curvature on the Y-axis and passing across an intersection of said second straight-linear line with the Y-axis, said circular arcs having different radii depending

upon distances of said respective straight-linear lines from the origin; and

rearranging the image data of respective pixels of the original image by transforming coordinates (x, y) of each pixel to coordinates (a, b), wherein "a" represents an x-distance of an intersection between the X-axis and one of said approximating circular arcs that has its center on the X-axis and passes across said coordinates (x, y), and "b" represents a y-distance of an intersection between the Y-axis and one of said approximating circular arcs that has its center on the Y-axis and passes across said coordinates (x, y).

2. An image data correction method as recited in claim 1, wherein the approximating circular arcs are expressed by the following equations, and said coordinates (a, b) are calculated by use of these equations:

$$Rx^2 = \{x - (a + Rx)\}^2 + y^2;$$

$$Ry^2 = x^2 + \{y - (b + Ry)\}^2;$$

$$Rx = \alpha / a^{2n}; \text{ and}$$

$$Ry = \beta / b^{2m},$$

wherein Rx represents a radius of the approximating circular arc having the center on the X-axis, Ry represents a radius of the approximating circular arc having the center on the Y-axis, and α, β, n and m represent coefficients predetermined in accordance with the distortion of the taking lens.

3. An image data correction method as recited in claim 2, further comprising the steps of:

substituting the value "x" for the value "a" if the absolute value |x| is less than a given small value, without carrying out the calculation according to the equations;

substituting the value "y" for the value "b" if the absolute value |y| is less than a given small value, without carrying out the calculation according to the equations; and

calculating the value "a" or "b" by use of said equations respectively if the absolute value |x| or |y| is not less than the given small value.

4. An image data correction method as recited in claim 2, wherein said coordinates (a, b) are transformed to coordinates (a', b') by use of the following equations, so as to eliminate influence of change in image magnification that is resulted from the curvature of the exposure frame at the exposure:

$a = \gamma a' + \delta a'^2$; and

$b = \epsilon b' + \zeta b'^2$,

wherein γ, δ, ϵ and ζ are proportional coefficients.

5. An image data correction method as recited in claim 4, wherein the coefficients α, β, n, m, γ, δ, ϵ and ζ are experimentally predetermined according to the types of cameras, including lens-fitted photo film unit, stored in a memory in association with respective camera types, and read out from said

memory in accordance with the camera type used for photographing the original image.

6. An image data correction method as recited in claim 5, wherein correlation between said coordinates (a', b') and said coordinates (x, y) is detected with respect to the entire exposure frame in accordance with the camera type, and is written as a lookup table in a memory, and wherein the image data of the respective pixels of the original image are rearranged from said coordinates (x, y) to coordinates (a', b') by use of said lookup table.

7. An image data correction method as recited in claim 2, wherein said coordinates (a, b) are calculated by use of said equations with respect to the first quadrant of said coordinate system, and are derived with respect to the second to fourth quadrant of said coordinate system from the values "a" and "b" obtained with respect to the first quadrant.

8. An image data correction method for correcting image data picked up from an original image photographed in an exposure frame on a photographic film through a taking lens while holding the exposure frame curved along a direction to be concave toward the taking lens, so as to eliminate image distortion in the original image, said image data correction method comprising the steps of:

obtaining a correlation between actual locations and ideal locations of respective pixels of the image data on the

original image by calculating an actual location of each pixel on the basis of an ideal location of said pixel and correction parameters, said ideal location corresponding to an ideal image point of said pixel formed on a flat exposure frame through an ideal taking lens having no distortion, and said correction parameters being predetermined in accordance with the distortion of the taking lens and the curvature of the exposure frame at the exposure; and

rearranging the image data by transforming each pixel to its ideal location in accordance with said correlation.

9. An image data correction method as recited in claim 8, wherein said actual and ideal locations of the respective pixels in the exposure frame are represented by coordinates of an orthogonal coordinate system having an origin at an intersection between an optical axis of the taking lens and the exposure frame, the X-axis of said coordinate system extending in the curved direction of the exposure frame, and the Y-axis of said coordinate system extending perpendicularly to the optical axis of the taking lens; and said correlation between said actual locations and said ideal locations are obtained by use of the following equations:

$$Fx = Rf \cdot \tan^{-1}\{Wx / (Rf - Wz)\};$$

$$Fy = \{(Lc - Wz) \cdot Dy\} / Lc;$$

$$Dx = Px \cdot (1+C\alpha \cdot \sqrt{H1}+C\beta \cdot H1+C\gamma \cdot H1^2);$$

$$Dy = Py \cdot (1+C\alpha \cdot \sqrt{H1}+C\beta \cdot H1+C\gamma \cdot H1^2);$$

$$H1 = \sqrt{(Px^2 + Py^2)};$$

$$Wx = \{-Dx / (M \cdot Lc)\} \cdot \{N-\sqrt{(N^2 - M \cdot Dx^2)} - M \cdot Lc)\};$$

$$Wz = \{N - \sqrt{(N^2 - M \cdot Dx^2)}\} / M;$$

$$M = 1 + (Dx^2 / Lc^2); \text{ and}$$

$$N = Rf + (Dx^2 / Lc),$$

wherein Fx and Fy represent an x-distance and a y-distance of said actual location of a pixel, Px and Py represent an x-distance and a y-distance of said ideal location of said pixel, $C\alpha$, $C\beta$, $C\gamma$ represent said correction parameters predetermined in accordance with the distortion of the taking lens, Rf represents a radius of curvature of the exposure frame at the exposure, and Lc represents a distance of a center of exit pupil of the taking lens to the intersection between the optical axis of the taking lens and the exposure frame, Rf and Lc being said correction parameters predetermined in accordance with the curvature of the exposure frame at the exposure.

10. An image data correction method as recited in claim 9, wherein said correction parameters $C\alpha$, $C\beta$, $C\gamma$, Rf and Lc are experimentally predetermined according to the types of cameras, including lens-fitted photo film unit, stored in a memory in association with data of respective camera types, and read out from said memory in accordance with the camera type used for photographing the original image.

11. An image data correction method as recited in claim 10, wherein data of said correlation between said actual locations and said ideal location are written as a lookup table in a memory, and is revised with the change of the camera type used for photographing the original image.

12. An image data correction method as recited in claim 11, wherein said actual locations are calculated by use of said equations with respect to the first quadrant of said coordinate system, and are derived with respect to the second to fourth quadrant of said coordinate system from values "Fx" and "Fy" obtained with respect to the first quadrant.

13. An image data correction method as recited in claim 8, wherein said the image data of said respective pixels of the original image are written on a first image memory at memory locations corresponding to said actual locations, and are rearranged by being rewritten on a second image memory at memory locations corresponding to said ideal locations.